

Society for American Archaeology

The Archaeological Visibility of Storage: Delineating Storage from Trash Areas

Author(s): Susan Kent

Source: *American Antiquity*, Vol. 64, No. 1 (Jan., 1999), pp. 79-94

Published by: [Society for American Archaeology](#)

Stable URL: <http://www.jstor.org/stable/2694347>

Accessed: 09/12/2010 05:01

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=sam>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact support@jstor.org.



Society for American Archaeology is collaborating with JSTOR to digitize, preserve and extend access to *American Antiquity*.

<http://www.jstor.org>

THE ARCHAEOLOGICAL VISIBILITY OF STORAGE: DELINEATING STORAGE FROM TRASH AREAS

Susan Kent

Despite the importance attributed to the study of storage behavior, little research has been conducted to determine whether it is even possible to distinguish storage areas from refuse areas. Archaeologists routinely separate storage pits from trash pits, but few have systematically investigated the defining characteristics of each. This study suggests that there is an archaeologically visible signature that can help researchers correctly interpret these loci. Research at occupied and recently abandoned camps among the now sedentary residents of Kutse in the Kalahari Desert of Botswana shows that refuse areas have a more homogeneous artifact inventory, regardless of the number of objects present. In contrast, non-trash activity areas at the same camps have a more heterogeneous, or diverse, inventory. The applicability and utility of this finding to the archaeological record is evaluated through the analysis of a Pueblo II Anasazi archaeological site from the southwestern United States. Patterns first recognized ethnoarchaeologically also appear to be recognizable in the archaeological record using the same methods. The results indicate that the statistical tests described here are applicable to distinguishing trash from other activity areas at archaeological sites.

A pesar de la importancia atribuida al estudio del almacenamiento, no se ha conducido suficiente investigación para determinar si es posible distinguir entre áreas de almacenamiento y áreas de desecho. Los arqueólogos rutinariamente separan pozos de almacenamiento de los de desecho, pero pocos han estudiado sistemáticamente las características que definen cada tipo de pozo. Este estudio sugiere que existe una huella visible arqueológicamente, la que puede ayudar a investigadores a interpretar correctamente estos rasgos. Investigaciones conducidas en campamentos ocupados o abandonados recientemente por los residentes sedentarios de Kutse en el Desierto Kalahari en Botswana indican que las áreas de desecho tienen un inventario artefactual más homogéneo, independientemente del número de artefactos presentes. En contraste, las áreas de actividad y almacenamiento tienen un inventario más heterogéneo o diverso. Se investiga la aplicabilidad y utilidad de este hallazgo a través del análisis de un sitio arqueológico. Anasazi del período Pueblo II en el suroeste de los Estados Unidos. Los patrones reconocidos etnoarqueológicamente también se reconocen en el registro arqueológico utilizando los mismos métodos. Los resultados indican que las pruebas estadísticas descritos aquí son aplicables para distinguir desecho de otras áreas de actividad en sitios arqueológicos.

The study of storage is important for understanding the past, yet few anthropologists have examined how one delineates storage in the ethnographic or archaeological records. Changes in storage behavior through time or geographical space have been used to support economic, environmental, social, and political explanations of the past (e.g., Arnold 1990; Binford 1978; Deal 1985, 1987; Dohm 1988; Euler 1988; Gilman, 1983, 1987; Gould 1982; Gross 1987; Hassan 1981; Hunter-Anderson 1986; Rowley-Conwy and Zvelebil 1989; Testart 1982, 1988). These extremely valuable theoretical arguments and models have been supported with rich data but often with few methods.

Before we can look at the causes and consequences of storage in prehistory, we first need to

investigate whether it is possible to distinguish storage areas from trash areas. If not, then many of our interpretations will be questionable, regardless of theoretical perspective. Does storage have a patterning of material culture that differentiates it from trash?

One way to address these questions is to consider data collected during the habitation of a camp, when the use of a locus can be observed. Such an endeavor allows archaeologists to solicit explanations for behavioral and material cultural patterning from the people producing them. Enabling archaeologists to distinguish storage loci from refuse areas in the present assists the analysis of storage behavior from the past.

Trash has been called the "obverse of storage" (Ingold 1983:555). Although both trash and storage

Susan Kent ■ Anthropology Program, Old Dominion University, Norfolk, VA 23529

will be examined, I am intentionally not including the storage of food in this study because agricultural storage bins, granaries, and similar features tend to be archaeologically recognizable. However, nonfood storage areas are as common or more common than trash areas in many societies with various economic emphases (Kent 1998).

Ethnoarchaeological Storage and Trash Patterns

There are two types of storage: informal and formal. All modern human societies use informal storage areas. Informal storage is the placement of objects on or in areas that are not specific in function for storage. Putting a spear or metate by the side of a hut when not in use is an example of informal storage. Informal storage areas consist of hut or windbreak walls or ceilings, trees, and bushes. The use of informal storage areas is ubiquitous, but is rarely visible in the archaeological record. Sedentary groups, however, also have formal storage areas, such as storage rooms or parts of rooms, where objects not in use are placed (Kent and Vierich 1989). Formal storage is the placement of objects in facilities used specifically for storage—e.g., storage platforms, pits, bowls or jars, and boxes. They are called formal storage areas because they consistently are used to store tools or other material culture, whereas informal storage areas, such as a tree, may store an object temporarily but are not specific in function for storage. Formal storage loci are almost exclusively found in semi- to completely sedentary societies and are only rarely found in highly mobile groups (Kent and Vierich 1989; Murray 1980). Because mobility has an important influence on storage practices, I chose sedentary groups to study both formal and informal storage areas.

Since 1987, I have spent part of each year studying storage practices at Kutse, Botswana, a recently sedentary community located just south of the Central Kalahari Game Reserve. Kutse residents are not agriculturalists and, hence, do not have specialized food storage facilities for the storage of grain or other agricultural produce. Complete feature and surface object inventories were compiled for each Kutse camp, some during site use, some after abandonment, and others both during and after occupation. All surface objects, regardless of size, located on features were recorded (features

include huts, windbreaks, formal and informal storage areas, trash/ash areas, kraals, and so on). This study includes 20,799 objects located at 247 individual features. At the time of recording, most objects inventoried at non-refuse areas were in informal or formal storage. Only a very small number of objects were in actual use at the time of the Kutse inventories.

To test the applicability of the ethnoarchaeological patterns in an archaeological context, the observations obtained from the data collected ethnoarchaeologically at Kutse are applied to data recovered archaeologically from a mid-Pueblo II Mesa Verde Anasazi site located in the southwestern United States. The site has well-defined and visible activity areas, so that midden or trash deposits can be readily distinguished from storage loci. This makes the Anasazi site an ideal archaeological test case.

Because I want to compare material assemblages from different sites, it is important to keep as many factors constant as possible. The Anasazi site examined here is a relatively small, sedentary, single-component habitation camp located in a semi-arid region where there is no constraint on space. Likewise, the Kutse sites examined are sedentary, single-component habitation camps occupied by one or more nuclear families located in a semi-arid region where there is no constraint on space (as there may be in densely forested areas). In contrast, large towns and cities may have different patterns of refuse disposal as might sites located in other areas of constrained space such as rockshelters (e.g., Mayan centers; Deal 1985, 1987). Such sites are probably not appropriate to apply the ethnoarchaeological research discussed here—targeted studies appropriate for urban and other areas need to be conducted first.

The two questions addressed below are:

- Is the material culture from trash areas and storage areas consistently different in ethnographic sites where the function of a locus is known?
- Are the same differences visible in the archaeological record?

Observations of Storage and Trash in an Ethnographic Context

Kutse residents, who are Central Kalahari hunter-gatherers, occupy camps from two months to two or three years (descriptions of the people and their

community can be found in Kent 1989, 1993a, 1993b, 1993c, 1995a, 1995b, 1996a, 1996b). Excluding visitors, camps are usually inhabited by five or more individuals (range 1 to 25). G/wi, G//ana, and a few Kūa Basarwa (Bushman or San) and Bakgalagadi Bantu-speakers live at Kutse. Interviews with adult residents, including former occupants of abandoned camps, covered a variety of topics, including how long they planned to occupy a camp and why. Intensive participant-observation fieldwork and time allocation data also provide information on the use of space and storage facilities.

Camps at which inhabitants plan a moderate-to-long occupation have more formal middens than sites where short occupations are planned. Sheet trash (a thin distribution of trash throughout a camp) is most common at camps at which inhabitants anticipate a short occupation. Refuse areas at semi-sedentary and sedentary Kutse camps also serve as ash dumps where accumulations of ashes from hearths are disposed. Refuse/ash areas are usually scattered in and around the periphery of the camp. It is possible to distinguish between formal storage areas and formal trash areas based on artifact content at the Kutse sites. The data below show that a relatively lower number of artifact categories is consistently associated with trash areas, regardless of the number of objects. This creates less heterogeneous artifact assemblages at trash areas than occur at storage areas.

Difficulties in Classification

There is no such thing as a "perfect" classification system. How one decides which object attributes and categories to use depends on the reason for grouping the objects in the first place. Because the intention was to compare the Kutse material culture with artifacts found elsewhere in an archaeological context, the categories used were based on object material, form, and function. For example, a tin can regularly used as a cooking pot was placed in a different category than a smashed can used as a pot holder. Cast iron pots used for cooking were placed in a third distinct category. Arrows were classified as different from spears or other hunting equipment, including snares, digging sticks, and bows. Consistent with classification systems used in archaeology, blanket threads were coded individually when completely unraveled and spatially apart

from any single piece of blanket. The latter is analogous to the way in which sherds are counted (noted individually or by weight, depending on the analysis).

It should be pointed out that there may still be some questions concerning the particulars of this classification. However, in all cases, there was consistency in how objects were classified. The same classification system was used at all Kutse camps, abandoned or occupied, and the same person, myself, categorized each item to enhance consistency. Because the focus of this article is not on the classification of objects, only a brief summary of methods is presented here. The data must be valid for ethnographic and archaeological test cases, and transcend hunter-gatherer or agriculturalist economic orientation, time period (contemporary or prehistoric), group ethnicity (Basarwa, Bakgalagadi, or Anasazi), geographical location, and object material type (whether Western materials or aboriginal). The measure selected was the diversity of artifact categories. Although some archaeologists may not agree that the diversity of categories at various features is the best measurement to distinguish storage from trash areas, it best suits this analysis.

Many investigators divide the concept of diversity into two dimensions: richness and evenness. "*Richness* is the number of different nominal classes of items observed in a sample regardless of their individual frequencies. *Evenness* is the relative proportion of representation of each of the classes present. The combined effect of richness and evenness usually corresponds to most people's intuitive idea of diversity" (McCartney and Glass 1990:522; original emphasis).¹ In this study I employ statistical techniques that combine both richness and evenness to obtain a measure of diversity.

Difficulties in Measurement

I first used a simple descriptive statistic to determine if there were any patterning present in the data that would warrant a more sophisticated analysis. I compared the mean number of objects per category per locus. The number of objects in a feature divided by the number of categories at the feature, resulted in a mean number of objects per category for each feature. This simple statistic is problematic for a variety of reasons, and I did not include fea-

tures with very small numbers of objects (usually under 10 artifacts) or unusually large numbers (such as a tin can with 230 wooden pegs used in staking out a hide or a locus where a blanket unraveled, leaving 190 threads). Such extremes were treated as "outliers" and were excluded from the analysis. With the exception of the few unusual loci mentioned above, no single category at Kutse accounted for more than 50 percent of the assemblage from any single locus. I interpret this finding to mean that, although the number of objects per category varies at individual camp loci, there are few instances of an assemblage highly skewed to a particular category.

Mean Number of Objects Per Category Statistic

As noted above, a few categories relative to large numbers of objects indicate a homogeneity of activities conducted at the locus. I hypothesize that the larger the inventory of different activities performed at a locus, the more categories relative to the number of objects are present, and the converse. A higher or larger mean number of objects per category might denote more object, and by extrapolation, activity redundancy, as characterizes trash areas used primarily to dump refuse. Long-term participant-observation fieldwork at eight different camps supported this supposition. In fact, the number of objects per category figure at Kutse is greatest at the ash/trash areas (Table 1). It is interesting that although kraals and windbreaks each have a

Table 1. Objects Located by Locus at Occupied and Non-Occupied Camps at Kutse. Features with Less Than a Total of 100 Objects from All Kutse Camps Were Recorded But Not Included Here
(Number of Camps Examined = 50; Number of Objects Recorded = 20,799 From a Total of 247 Individual Features; Largest Number of Objects Per Locus Per Camp = 85).

Locus	Number of Categories	Number of Objects		Objects/categories
Refuse/Ash area	141	7,299	=	51.8
Hut	416	7,063	=	17.0
Kraal	68	784	=	11.5
Windbreak	352	3,918	=	11.1
Informal storage area	104	1,027	=	9.9
Roasting pit	39	283	=	7.3
Hearth	43	227	=	5.3
Storage platform	58	198	=	3.4

Table 2. Objects Located by Locus Only at Abandoned Camps at Kutse
(Number of Camps = 24; Number of Objects = 5,047 from a Total of 84 Individual Features)

Locus	Number of Categories	Number of Objects		Objects/categories
Refuse/ash area	80	3,367	=	42.1
Hut	121	746	=	6.2
Windbreak	95	504	=	5.3
Kraal	32	264	=	8.3
Roasting	11	63	=	5.7
Hearth	11	59	=	5.4
Informal storage area	20	40	=	2.0
Storage platform	3	4	=	1.3

vastly different number of objects, they have very similar measures of objects per category and, as discussed below, diversity figures (Tables 1 to 3). The figures show that sample size is not influenc-

Table 3. Diversity Measure Values for Loci at the Kutse Community (Numbers Differ Slightly in Tables 2 and 3 Because Features With Less Than a Total of 100 Objects Were Not Included in Those Tables).

	N	Diversity Measure Value
<i>All Kutse Camps Included</i>		
In-between Features (i.e., Sheet Trash)	6,755	0.0178
Windbreak	3,922	0.7593
Hut	7,169	0.7552
Ash/Trash Area	7,450	0.4483
Formal Storage Area	198	0.5244
Goat Corral	867	0.7348
Informal Storage Area	1,030	0.5754
TOTAL NUMBER OF OBJECTS	27,391	
<i>Only Occupied Camps Included</i>		
In-between Features	3,203	0.0127
Windbreak	3,576	0.7714
Hut	6,158	0.7602
Ash/Trash Area	3,770	0.4298
Formal Storage Area	194	0.5172
Goat Corral	549	0.8131
Informal Storage Area	937	0.5618
TOTAL NUMBER OF OBJECTS	18,387	
<i>Only Abandoned Camps Included</i>		
In-between Features	3,552	0.0214
Windbreak	338	0.4485
Hut	574	0.4912
Ash/Trash Area	3,259	0.4342
Formal Storage Area	4	*
Goat Corral	274	0.5849
Informal Storage Area	34	*
TOTAL NUMBER OF OBJECTS	8,035	

* Too few to calculate

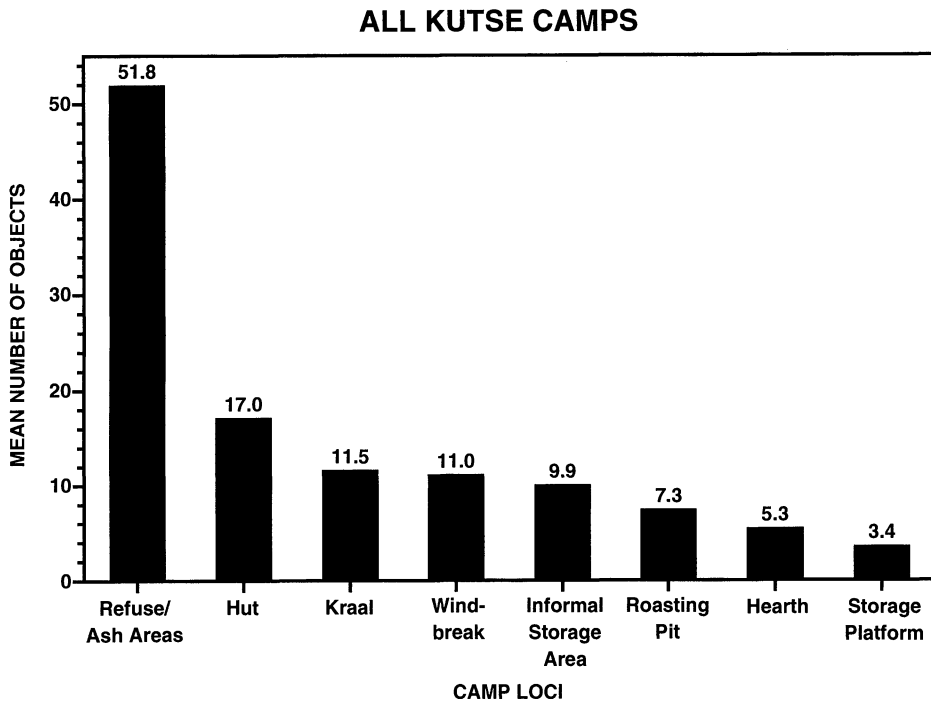


Figure 1. Bar diagram of mean number of objects per category at Kutse camps, Botswana.

ing the number of categories present at different loci.

These patterns appear to be the result of behavior. If they were not, one would expect the loci with the most objects to have the same number or more categories than ones with fewer objects. The number of rare categories should increase with the size of the assemblage. However, that is not the pattern found here. The mean is the same at different loci with very different numbers of objects. Table 1 shows that ash areas have more than double the next largest mean number of objects per category figure (Figure 1). Whereas refuse/ash areas and huts have roughly the same number of objects (7,299 for the trash areas and 7,063 for huts), they have significantly different numbers of categories (141 categories for trash areas and 416 categories for huts). The result is very different mean objects per category values (Figure 1). The absolute number of categories decreases at some loci where object number increases. This observation cannot be attributed simply to differences in the number of objects across loci. Loci with roughly similar numbers of objects have very dissimilar mean numbers of objects, again indicating disposal behavior is responsible for this patterning.

Since I wanted to compare the ethnoarchaeological data to archaeological data, I thought it prudent to examine separately the average number of objects per category from occupied and abandoned Kutse camps. Many of the objects recorded at currently occupied camps were perishable materials that would not likely be left or be archaeologically visible after camp abandonment (Schiffer 1987). I inventoried 24 abandoned camps, which had a total of 84 features. Camps had been abandoned from one to seven years. Most features were still visible, but extremely fragile objects did not preserve. Table 2 shows that ash/trash areas at abandoned camps, like those at still occupied camps, have the greatest (over double) mean number of objects per category (Figure 3). To determine whether the mean number of objects per locus was significantly different, *t*-tests were calculated. The mean of the non-trash areas is significantly different from the mean of refuse/ash areas (i.e., *p* is less than 0.05).²

To facilitate comparisons with a single archaeological site, the data were separated by camp, locus, and type of object. I wanted to determine whether the patterns delineated from a group of sites (i.e., aggregated data) were still visible when examining a single site by itself. The mean number of objects

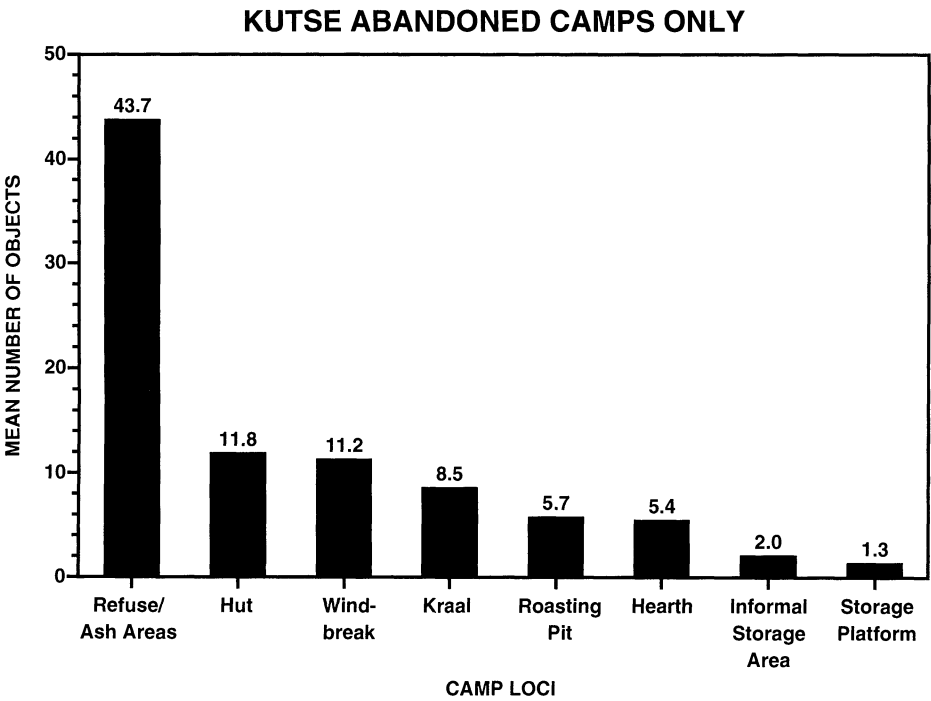


Figure 2. Bar diagram of mean number of objects per category at only abandoned camps at Kutse, Botswana.

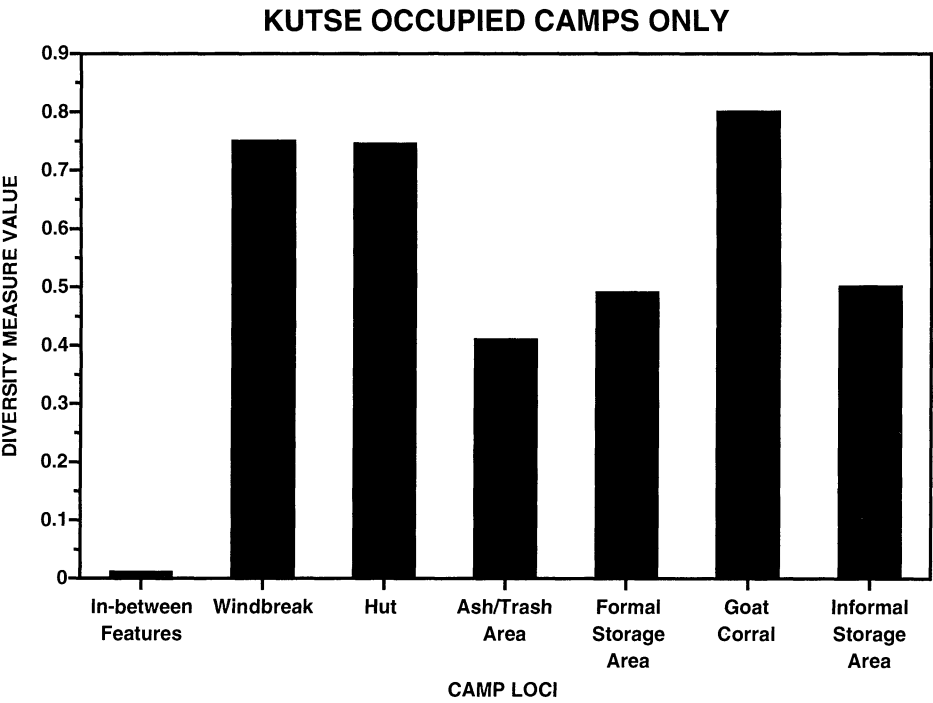


Figure 3. Bar diagram of the Teachman statistic measure of diversity only at occupied camps at Kutse, Botswana.

per category was calculated for each locus at all camps. Even on the single camp level, ash/trash areas have the largest mean number of objects per category at 88 percent of these sites. The few camps where ash areas do not contain the greatest number of objects/category tend to have a small total number of artifacts located at one or more of the features. This pattern may be due to the fact that the loci all have less than 100 objects and often less than 50.

The Teachman Information Statistical Measure of Diversity

To further evaluate the material culture patterning, I employed a modification of the information theoretic statistic adapted from Teachman (1980:340–344). Information theoretic statistics are not completely without problems, as documented by a number of archaeologists (e.g., Jones and Leonard 1989; Leonard and Jones 1989). Most of these archaeologists correctly criticize statistics, such as the Shannon statistic of diversity, for being influenced by sample size differences.³ Even so, none of the alternatives suggested thus far are without their own problems, some with difficulties in assumptions or use that are equal to or greater than those of the Shannon and other diversity measures. Because there is no perfect measure, I looked at two different ones: mean number of objects per category which seems to be correlated with the number of different types of activities performed at a locus, and the Teachman diversity statistic described below. Both statistics reinforce the other, demonstrating that lower means per category and higher diversity values identify storage and similar non-trash areas.

The particular statistic used here, which I refer to as the “Teachman” statistic, is not subject to the sampling size biases that Leonard and Jones (1989) point out as a major limitation of the Shannon Information Statistic. First, the Teachman statistic is based on a probability distribution, which is not affected by sample size. Second, since all activity areas were inventoried at a site, what I observed and consequently used in the analysis is the universe of all objects from all categories at all features at camps—not samples from specific loci. Therefore, the number of categories recorded constitutes the theoretical maximum, designated as *I*. In theory, if objects were evenly distributed, the

probability of observing any category would be $1/I$. If there was no difference in the diversity of objects across loci, any category would have the same probability of being observed in any locus, which would, in turn, produce the same index.

In addition, the Teachman’s statistic has two practical advantages over the Shannon’s Information Statistic. First, it is normalized against the theoretical maximum wherein all categories are observed and objects are evenly distributed among all categories. Therefore, it generates a value of 1 when objects are evenly distributed, indicating maximum diversity, and a value of 0 when all objects are concentrated in one single category, indicating minimum diversity. Second, the Teachman statistic always generates a positive value, with a larger value indicating greater diversity. This makes the interpretation of the statistic more practical and intuitively sensible. Thus, whether a category is observed in a locus is not related to sample size but reflects “something else” that is influencing the distribution of categories.

The Teachman statistic measures diversity and was applied to objects located at recently abandoned Kutse camps using data recorded in different field seasons from 1988 to 1992. The Teachman statistic of diversity (Teachman 1980:344) is:

$$DM = \sum_i p_i (\log (1/p_i))$$

where DM is Diversity Measure and *p* is the probability of objects within a category⁴.

To have the DM vary between 0, indicating minimum diversity, and 1, meaning maximum diversity, it is necessary to standardize or normalize DM. The following equation was used:

$$DM' = DM / \log (I)$$

where *I* is the theoretical maximum or the total number of possible categories and $\log (I)$ is the theoretical maximum value of DM. By using the probability of observing each category instead of the absolute number of objects in each category, the Teachman diversity statistic takes into account the different number of objects located at each area, thereby controlling for different numbers of objects per locus. A full description of the statistic and its application is in Teachman (1980). The statistic was used to calculate a diversity measure at loci that have 50 or more objects per camp. The major-

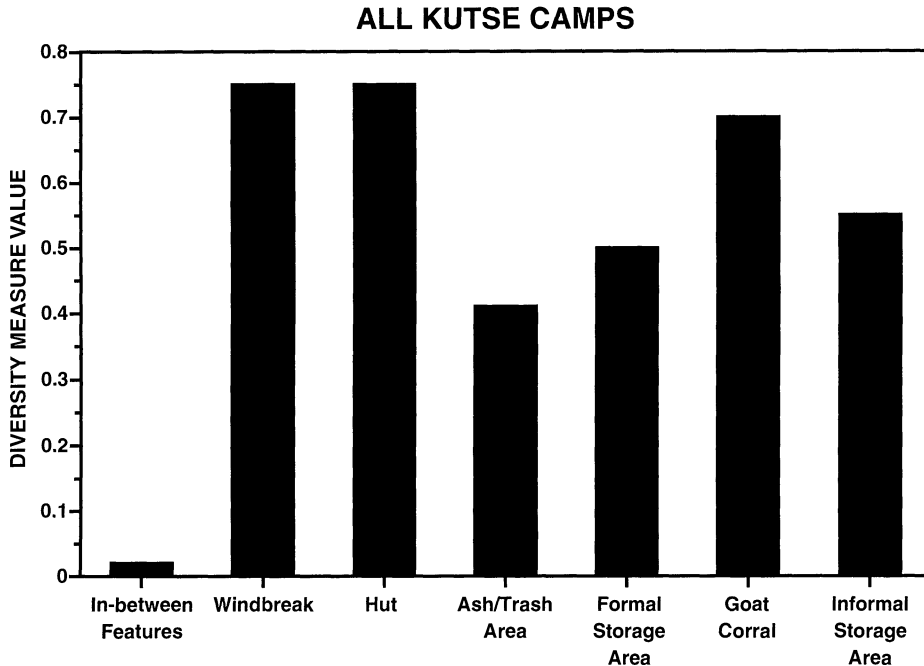


Figure 4. Bar diagram of the Teachman statistic measure of diversity at all camps located at Kutse, Botswana.

ity of the huts and windbreaks have a diversity figure around 0.400 whereas most ash/trash areas have a diversity figure of about 0.340.

Table 3 shows that areas of known trash accumulations, such as in-between features (i.e., "sheet trash") have the lowest diversity measure value by far. They are followed by ash/trash loci. It is evident, then, that trash areas consistently have the lowest values of all the loci regardless of whether all the camps are examined together, only the occupied camps are compared, or only the abandoned camps are analyzed by themselves. Consistently, refuse areas have the least amount of diversity while all other loci, from huts to windbreaks to informal and formal storage areas, have a higher value (Figure 4). Note the agreement between the values for the diversity measure and the mean number of objects per category figure at, for example, ash/trash areas and huts at all camps or at various features and ash/trash areas at abandoned camps alone (Figures 2 and 5).

Regardless of whether the Teachman diversity statistic or various simple descriptive statistics are used, refuse/ash areas are significantly different from storage and other activity areas. In fact, the difference from other loci is such a strong attribute of

trash/ash areas that it was noticeable while in the field conducting the camp inventories. One reason for the difference among areas may be that storage areas are often located near activity areas of various types. For example, at Kutse, storage platforms were built to store items, but people also sat under the platform in the shade to perform various activities. In huts, the back area opposite the door was a formal storage area but sleeping, eating, and other activities occurred nearby. Informal storage areas, by definition, are areas at which storage is not the sole activity. Examining the archaeological record alone, are trash areas recognizably different from storage in the same way that they are ethnographically?

Archaeological Observations of Storage and Trash

A cross-cultural examination of societies suggests that the pattern observed at Kutse is not tied to a particular culture (Kent 1990). The study reveals similarities or regularities in storage patterns that suggest the possibility that the findings may be generalized to different societies. Are the Teachman measurement of diversity and the mean number of objects per category visible and correspond in the same direction in archaeological data

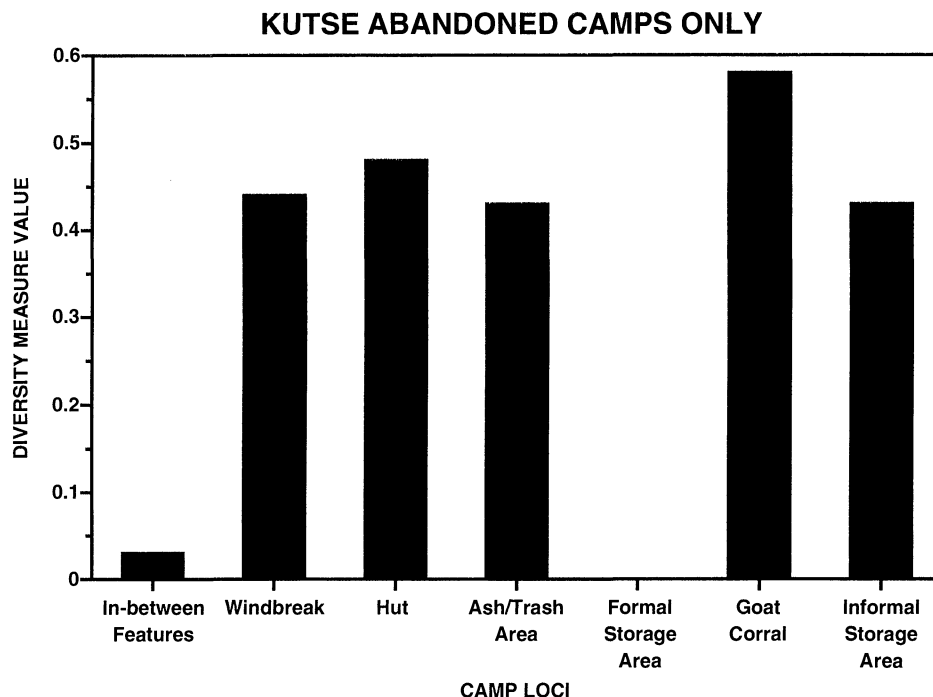


Figure 5. Bar diagram of the Teachman statistic measure of diversity only at abandoned camps located at Kutse, Botswana
Note: Not enough objects were recorded from formal storage areas in the abandoned camps; therefore, no bar is plotted on this figure.

as that documented at Kutse? To answer this question, I applied the ethnoarchaeological findings to Gnatsville, a small, single component, Mesa Verde Anasazi mid-Pueblo II habitation located in southwestern Colorado (Kent 1992). Site configuration, artifact inventory, and object distribution all indicate that the single component site was occupied year-round between circa A.D. 1030–1050 (for a description of the artifacts, stratigraphy, dates, type of sedentism represented, and site structure, see Kent 1991, 1992).

With the exception of formal storage areas such as storage pits, storage had to be inferred as more likely within the rubble mound than in the midden (as huts at Kutse were the locus of formal storage). Material culture from five areas at Gnatsville was analyzed. These areas were the rubble mound (which contained several rooms); kiva; midden; a secondary, more temporary midden with a hearth located stratigraphically above it (Area A); and randomly placed units excavated outside these features (see Kent 1991:Figures 2, 3, 5). Since probability units were areas not associated with a feature, and since I wanted data comparable with that collected at Kutse, Gnatsville probability sampling units

were not included in this study. The context of the artifacts from these randomly selected units is ambiguous. Some probability units may represent portions of formal storage areas that were undetected since the entire horizontal area was not excavated. At the same time, other probability units likely represented sheet trash, complicating the interpretation of their use and their reliability for testing the applicability of the diversity and mean objects/category statistics in the archaeological record.

A number of formal storage loci were identified at Gnatsville. These included a very large bell-shaped pit and a slab-lined storage cist. Consistent with the ethnoarchaeological data presented below, these storage loci were not found at other nearby sites of comparable date that were occupied for a shorter duration (Kent 1992). The reason I selected Gnatsville to test the archaeological consistency of the ethnoarchaeologically derived observations was because the activity areas were recognizable, discrete, and general function was identifiable. The site analysis can be seen as an independent test of the methods.

At Gnatsville, we can assume that storage areas

occurred in the rubble mound (the remains of a small room block) as they occur in most habitation structures, including those at Kutse and elsewhere. A prominent midden also was identifiable at the site. Would the Teachman statistic and the mean number of objects per category analysis support the identifications of the loci as trash or storage made independently of either statistic?

Comparability of Categories and Classification

To enhance the comparability with other nearby sites, Gnatsville artifacts were classified using the Dolores Archaeological Project categories (described in Kent 1991,1992; Blinman 1984; Blinman et al. 1984). The analysts themselves were all part of the Dolores Archaeological Project to further ensure comparability with other sites in the area. As was true with the ethnoarchaeological categories, archaeological categories were based on object function, form, and material type. For example, flaked lithics were classified separately from ground stone artifacts. Within flaked lithics, projectile points were classified separately from biface (“knives”) and non-utilized flakes.

Ceramic categories obviously posed more of a challenge in terms of comparability with the ethnoarchaeological classification scheme than did the other material classes. The difficulty of comparability stems from the presence of two sources of variation among the ceramics: (1) the number of categories based on a vessel form, such as ceramic scraper or bowl dipper or jar, and (2) the number of ceramic types present, such as Cortez Black-on-White or Mancos Corrugated. These categories also were based on function, form, and ware type. As part of the analysis, the number of sherds per type per vessel form was calculated.

Classification of the ceramics by type and function/form is consistent with the manner in which the Kutse objects were categorized. For instance, Kutse ceramic mugs were placed in a different category from enamel mugs or enamel tea cups. Even though I tried to establish categories that would maximize comparability, the question still remains: Is a category for tin can containers analogous to a category for ceramic containers and do both vary in the same manner? Definitely some ethnoarchaeological and archaeological categories are more comparable than others. This is the reason why aggregated category data are examined rather than

Table 4. Objects Located at Gnatsville, a Small Pueblo II Anasazi Site. Categories Include Modified Flakes, Unmodified Flakes, Manos, Ceramic Scrapers, Bowls and Jugs (Miniature Bowls are a Separate Category), Etc.

Locus	Number of Categories	Number of Objects	Objects/Categories
<i>Lithics Only (Flaked and Groundstone)</i>			
Midden	11	1,253	113.9
Area A	10	380	38.0
Rubble mound	23	570	24.8
Kiva	14	112	14.0
<i>Ceramics Only (Divided By Type)</i>			
Midden	5	89	17.8
Rubble mound	8	53	6.6
Area A	4	15	3.8
Kiva	7	21	3.0
<i>All Objects and All Categories (Lithics, Faunal Remains, and Ceramics)</i>			
Midden			80.5
Rubble mound			35.0
Area A			22.2
Kiva			12.2
<i>All Objects Except Ceramics (i.e., Lithics and Faunal Remains)</i>			
Midden			104.4
Area A			38.8
Rubble mound			27.2
Kiva			10.5

individual categories. Analyzing aggregate data reduces the potential problems associated with an one-to-one comparison. Nonetheless, for those who find no comparability possible between the Gnatsville ceramics and the Kutse inventory, two figures are provided, one excluding ceramics and one including them (Table 4). Note that the results from the ceramic analyses are congruent with those from the lithic analyses, implying at least some comparability between lithic and ceramic assemblages and those categories employed at Kutse (Figure 6).

Trash Areas Versus Storage Areas

The Teachman statistic of diversity described above reveals that the kiva is most heterogeneous (0.434513), followed by the rubble mound (0.348548) and Area A (0.325138). The least diverse area at the site is the main midden (0.275499) (Figure 7). Trash areas are less diverse than non-refuse areas at both occupied and abandoned camps at Kutse and at the abandoned Anasazi site. During excavation, it was further noted that the

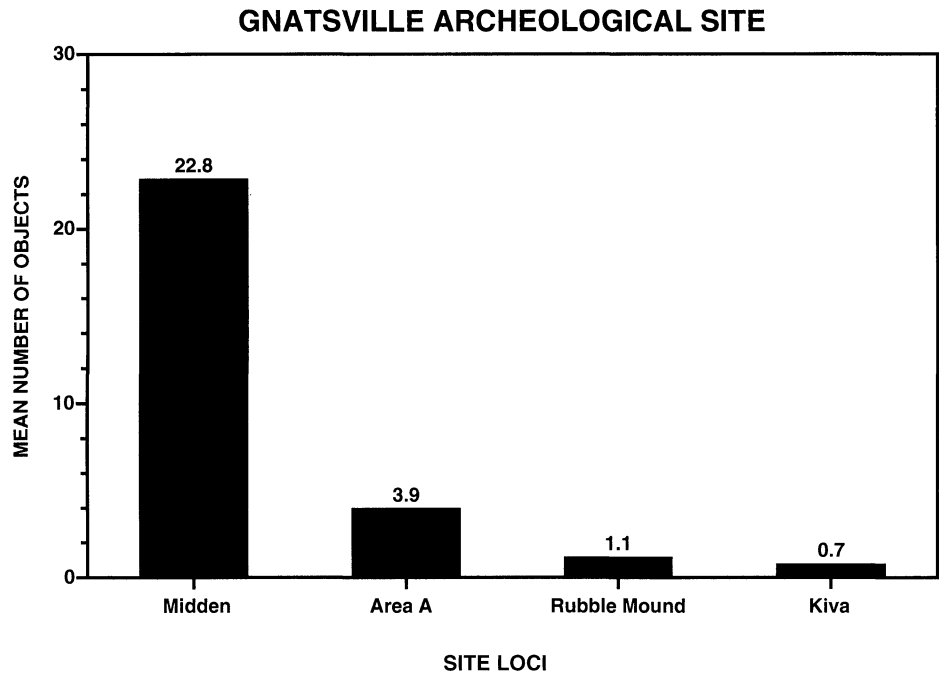


Figure 6. Bar diagram of mean number of objects per category by features at Gnatsville, Colorado, USA.

density of objects, except for ceramics, at the lower levels below a hearth was higher at Area A than anywhere else at the site, with the exception of the formal midden (Tables 4–5). Area A was not visible

from the surface and was located southwest of the rubble mound and kiva. The area contained fill that was found stratigraphically below a hearth located at the margin of the feature’s midden deposit, about

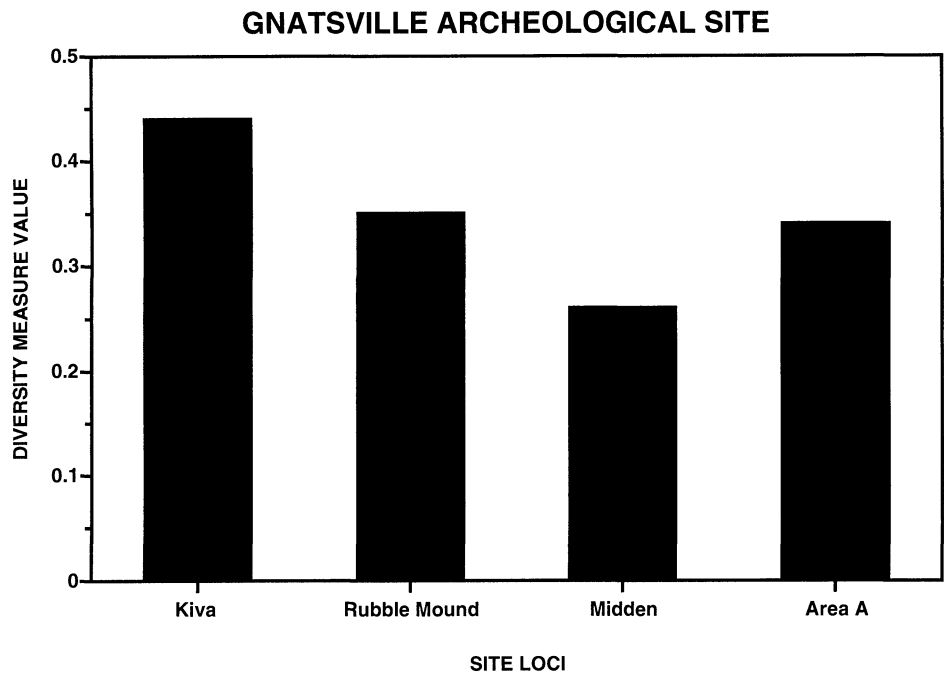


Figure 7. Bar diagram of the Teachman statistic measure of diversity at features located at Gnatsville, Colorado, USA.

Table 5. A. Objects Per Cubic Meter of Excavated Soil Per Locus at Gnatsville, A Small Pueblo II Anasazi Site (Surface Artifacts Not Included). B. All Objects at a Feature Divided by the Number of Categories Located at a Feature Per Cubic Meter of Excavated Soil.

A					
Area	Faunal Remains	Ceramics (number of objects per cubic meter)	Flaked Lithics	Groundstone Lithics	Total
Midden	0.8	311.3	297.3	1.1	592.6
Area A	7.1	32.8	55.9	0.8	96.7
Rubble mound	2.3	37.6	14.4	0.7	55.0
Kiva	2.3	12.0	5.2	0.5	20.0

B	
Locus	Objects/Cubic Meter/Categories Combination of All Objects Divided by All Categories per Cubic Meter
Midden	22.8
Area A	3.9
Rubble mound	1.1
Kiva	0.7

2 m to the south of the kiva. The fill was very ashy and contained the second highest concentration of artifacts found at the site, rivaled in number only by the large, formal midden. Because the clayey matrix of the kiva floor was uncovered in a part of this feature, it is suggested that Area A served as the initial midden for the site during the kiva construction (Kent 1991:64). Study of the stratigraphic profile and analysis of the cultural material and features at Gnatsville supports the conclusion that Area A had originally been a small midden that was later converted into a living area (see stratigraphic profile in Kent 1991:Figure 5).

Because Area A had two distinct functions—initially a midden and later an activity area of some kind with an associated hearth—the values for the objects per category figure should fall between those for midden and non-midden areas. This is precisely what occurs. The Teachman statistic indicates that Area A is intermediate in its category diversity and resembles numbers from non-refuse loci at Gnatsville (which actually was its last function) more than figures from the midden (Figure 7).

The same conclusion is appropriate when viewing the mean number of objects per feature. Even when the amount of dirt excavated per feature is taken into account, the number of all objects together per category (and per cubic meter), Area A is again indeterminate, but closer to the figure for non-refuse areas (Table 5). This finding is perhaps explicable given that the entire site was not occu-

pied for more than a few decades and that the locus was last used for non-refuse activities. That is, the material culture patterning in the feature more closely reflects the last activities performed before abandonment than the different activities initially performed at the locus (as also noted by Stevenson 1985, 1991). Whether one examines each material class separately (e.g., lithics or ceramics) or as a group, the formal midden consistently is more repetitive in categories or has a lower category diversity according to the Teachman statistic than that found at any other feature (Figures 5 and 6).

Sedentism and Trash Areas

Trash at Basarwa camps at which inhabitants plan to stay for a brief period, usually less than three months, is scattered as sheet trash. Refuse is rarely deposited at a specific locus. At semi-sedentary or recently sedentary communities such as Kutse, discrete trash areas are located throughout a camp, as long as occupants plan to stay more than a short period of time. Several camps have an ash/trash area adjacent to the central windbreak hearth at which most activities are performed. It is interesting that I observed a Kutse family not use trash areas when they anticipated a brief stay of less than three months in the community—that is, most refuse was sheet trash. However, the same family did use discrete ash/trash areas when they planned to stay more than six months at a different Kutse camp several years later. My research with other

societies more accustomed to sedentism, such as the semi-sedentary to short-term sedentary Navajo who today occupy camps for six months to less than five years, indicates that Navajos place middens away from the main activity areas, although not necessarily on the periphery of the camp. Long-term, established sedentary societies, such as the Highland Maya and other Mesoamerican groups, tend to place trash areas on the perimeter of a plaza or site (Deal 1985). These trash areas are quantitatively different from those found at Kutse (see Hayden and Cannon 1983; Deal 1985; Arnold 1990). Informal storage, while probably always present for anatomically modern humans is, according to my research, probably not archaeologically visible.

Although not very common at the Kutse sites, abandoned parts of the community at many other longer-term sedentary villages or cities are used for trash disposal. Not only has this been ethnographically observed in various societies from Mesoamerica to the North American Southwest (e.g., Deal 1985), but also prehistorically interpreted at a variety of archaeological sites. It is interesting, therefore, that the Teachman diversity statistic allowed us to interpret the ambiguous Area A as a locus at which refuse was deposited and was later reused as an activity area with a hearth.

The Teachman statistic is a relative measure that allows archaeologists to infer which loci were most likely middens and which were more likely storage at a site. Rather than providing absolute numbers for classifying loci within or between sites, the areas with the lowest diversity tend to be, in most cases, trash deposits in contrast to loci at the same site with high diversity figures. I suggest that a higher diversity of categories found at storage areas in contrast to trash areas may occur because some categories are deliberately not deposited at refuse areas. Categories of items that have religious/ritual, sociopolitical, and similar meaning tend not to be discarded unless they lose their symbolism. Objects and/or raw material that are hard to procure may similarly be curated and not often disposed of in a midden. At the same time, I suggest that a larger number of different types of activities are performed at or near storage areas. Trash areas tend to be characterized by one activity, dumping trash, at any one time, assuming the function of the area does not change through the life history of the site.

In contrast, storage areas are often located near, if not part of, areas with more than one activity. The presence of more than one activity performed at these other loci is reflected in the material culture in terms of a lower mean number of objects per category. More "categories" of behavior occur, resulting in more categories of material culture present. This results in a higher diversity value and lower mean number of objects per category. Research is needed to determine whether a highly specialized activity area, such as a manufacturing locus for one type of object, will mimic refuse areas.

Conclusion

While one may have expected pronounced differences in the pattern of object diversity characteristic of functionally different loci from such dissimilar cultures and time periods as modern Kutse residents of the Kalahari Desert, Botswana, and Pueblo II Mesa Verde Anasazi from Colorado, and Navajo Indians from Utah (although I only have qualitative data for the latter), the pattern is notably consistent. Such consistency suggests that the pattern of low diversity at trash areas in comparison to other loci at a site is both cross-culturally and cross-temporally valid and therefore potentially useful to archaeologists in various regions and time periods. Trash area artifact assemblages are more redundant in the object types represented than are storage areas which are more heterogeneous. Although this finding appears to be reliable for various sedentary sites as those included here, the same pattern does not appear to be equally valid for sites occupied by nomadic peoples. Instead, at nomadic camps occupied for a relatively brief period, refuse tends to be scattered throughout as sheet trash. While observations conducted in the Kalahari indicate that trash is not usually deposited at a separate locus when the occupation is anticipated to be brief, further assessment is needed to determine its cross-cultural validity and reliability. However, evaluating the material culture patterning at sedentary sites show that storage and trash areas are recognizably different in the same ways at archaeological sites as they are at modern sedentary occupations.

Diversity of activities leaves a diversity of material culture, as observed through participant-observation fieldwork, inventories of occupied and abandoned camps, and interviews with former

occupants about the use of loci at camps. Through artifacts, this diversity is expressed at Kutse in the lower mean number of objects per category figure and also by a higher diversity statistic value at loci where multiple activities occurred. The above analyses indicate that it is possible to differentiate trash areas from storage areas in the archaeological record. Because the distinction can be made, we can study various facets of storage behavior using archaeological data. To give context and meaning to the data, it is necessary to examine them from the perspective of a model of the organization of storage that is neither based on Western culture nor specific to any one group or one time period. A model of storage behavior is presented elsewhere (Kent 1998). The above is one attempt to distinguish trash from non-trash loci at sites. It is the first step that permits the second step of investigating differential trash disposal and the sociopolitical organizational changes of storage through time. Both steps are ultimately necessary to understand how and why sites are organized.

This study does not provide the definitive statement on the archaeological visibility of storage loci. Instead it is a beginning that points out several consistencies in trash areas that appear to be cross-culturally valid, at least with the societies from which I have data. The analyses presented here are examples of methods to differentiate loci by function and the resulting patterning of material culture.

Acknowledgments. A preliminary draft was greatly improved by valuable comments from Xiushi Yang, Michael Deal, Ben Nelson, Martha Graham, Sarah Schlanger, Randy Gainey, Robert Leonard, and Stephen Plog. However, none of these people should be held responsible for any inadequacies that may remain. I am grateful to Lynne Goldstein for allowing me to revise and resubmit this manuscript. I greatly appreciate the following statisticians for their important help with the manuscript: Xiushi Yang, Jay Teachman, and Dayanand Naik. Each provided valuable suggestions concerning the quantitative portion of the manuscript, ODU Graphics for drafting, and Denise Elliott and Marion Blue provided editorial advice.

I am most grateful to the government of Botswana for granting me a research permit to conduct the study which forms the basis for much of this paper. I especially thank the Office of the President, Botswana, Ministry of Local Government and Lands, and the National Museum and Art Gallery of Botswana. I will always be indebted to the people of Kutse who allowed me to live in their camps and share in a part of their lives. I thank the U.S. Bureau of Land Management for permission to excavate on BLM land. Funding from the American Philosophical Society and Sigma

Xi made the archaeological research described here possible, and funding from the Swan Fund, Fulbright Foundation, Wenner-Gren, and Old Dominion University made the ethnoarchaeological research possible.

References Cited

- Arnold, P.
1990 The Organization of Refuse Disposal and Ceramic Production within Contemporary Mexican Households. *American Anthropologist* 92:915–932.
- Binford, L.
1978 *Nunamiut Ethnoarchaeology*. Academic Press, New York.
- Blinman, E.
1984 Dolores Archaeological Program Ceramic Dating: Justification and Procedures. Technical Reports No. DAP-144. Dolores Archaeological Program, USDI Bureau of Reclamation, Engineering and Research Center, Denver.
- Blinman, E., D. D. Wilson, R. Waterworth, M. Erickson, and L. Hart
1984 Additive Technologies Group Laboratory Manual. Technical Reports No. DAP-149. Dolores Archaeological Program, USDI Bureau of Reclamation, Engineering and Research Center, Denver.
- Cowgill, G.
1989 The Concept of Diversity in Archaeological Theory. In *Quantifying Diversity in Archaeology*, edited by R. Leonard and G. T. Jones, pp.131–141. Cambridge University Press, Cambridge.
- Deal, M.
1985 Household Pottery Disposal in the Maya Highlands: An Ethnoarchaeological Interpretation. *Journal of Anthropological Archaeology* 4:243–291.
1987 Household Pottery Storage and Site Structure: A View from the Maya Highlands. Paper presented at 52nd Annual Meeting of the Society for American Archaeology, Toronto.
- Dohm, K.
1988 *The Household in Transition: Spatial Organization of Early Anasazi Residential- Domestic Units, Southeastern Utah*. Ph.D. dissertation, Washington State University. University Microfilms, Ann Arbor.
- Euler, R.
1988 Demography and Cultural Dynamics on the Colorado Plateaus. In *The Anasazi in a Changing Environment*, edited by G. Gumerman, pp. 192–229. Cambridge University Press, Cambridge.
- Gilman, P.
1983 *Changing Architectural Forms in the Prehistoric Southwest*. Unpublished Ph.D. dissertation, University of New Mexico, Albuquerque.
1987 Architecture as Artifact: Pit Structures and Pueblos in the American Southwest. *American Antiquity* 52:538–564.
- Gould, R.
1982 To Have and Have Not: The Ecology of Sharing among Hunter-Gatherers. In *Resource Managers: North American and Australian Hunter-Gatherers*, edited by N. Williams and E. Hunn, pp. 69–91. Selected Symposium 67. American Association for the Advancement of Science, Washington, D.C.
- Gross, G. T.
1987 *Anasazi Storage Facilities in the Dolores Region, Colorado: A.D. 600–920*. Ph.D. dissertation, Washington State University. University Microfilms, Ann Arbor.

- Hassan, F.
1981 *Demographic Archaeology*. Academic Press, New York.
- Hayden, B., and A. Cannon
1987 *The Structure of Material Systems: Ethnoarchaeology in the Maya Highlands*. SAA Papers No. 3. Society for American Archaeology, Washington, D.C.
- Hunter-Anderson, R.
1986 *Prehistoric Adaptation in the American Southwest*. Cambridge University Press, Cambridge.
- Ingold, T.
1983 The Significance of Storage in Hunting Societies. *Man* (NS) 18:553–571.
1987 *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. University of Iowa Press, Iowa City.
- Jones, G. T., and R. Leonard
1989 The Concept of Diversity: An Introduction. In *Quantifying Diversity in Archaeology*, edited by R. Leonard and G. T. Jones, pp. 1–3. Cambridge University Press, Cambridge.
- Kent, S.
1989 And Justice for All: The Development of Political Centralization among Newly Sedentary Foragers. *American Anthropologist* 91:703–711.
1990 A Cross-Cultural Study of Segmentation, Architecture, and the Use of Space. In *Domestic Architecture and the Use of Space—An Interdisciplinary Cross-Cultural Study*, edited by S. Kent, pp. 127–152. Cambridge University Press, Cambridge.
1991 Excavations at a Small Mesa Verde Pueblo II Anasazi Site in Southwestern Colorado. *Kiva* 57:55.
1992 Understanding Variability in the Archaeological Record: Application of an Ethnoarchaeological Model for Distinguishing Mobility Patterns. *American Antiquity* 57:635–550.
1993a Models of Abandonment and Material Culture Frequencies. In *Abandonment Processes: Seasonal Variation and Regional Mobility*, edited by C. Cameron and S. Tomka. Cambridge University Press, Cambridge.
1993b Variability in Faunal Assemblages: The Influence of Hunting Skill, Sharing, Dogs, and Mode of Cooking on Faunal Remains at a Sedentary Kalahari Community. *Journal of Anthropological Archaeology* 12:323–385.
1993c Sharing in an Egalitarian Kalahari Community. *Man* (NS) 28:479–519.
1995a Unstable Households in a Stable Community: The Organization of a Recently Sedentary Settlement. *American Anthropologist* 97:297–312.
1995b Does Sedentarization Promote Gender Inequality? A Case Study from the Kalahari. *Journal of the Royal Anthropological Institute* 1(3):513
1996a Cultural Diversity among African Foragers. In *Cultural Diversity among Twentieth Century Foragers: An African Perspective*, edited by S. Kent, pp. 125–157. Cambridge University Press, Cambridge.
1996b Hunting Variation in a Recently Sedentary Kalahari Community. In *Cultural Diversity among Twentieth Century Foragers: An African Perspective*, edited by S. Kent, pp. 1–18. Cambridge University Press, Cambridge.
1998 The Organization of Storage Areas: A Cross-Cultural, Ethnoarchaeological Perspective. Manuscript on file, Anthropology Program, Old Dominion University, Norfolk, Virginia.
- Kent, S., and D. Dunn
1993 The Etiology of Hypoferremia in a Recently Sedentary Kalahari Village. *The American Journal of Tropical Medicine and Hygiene* 48(4):554–567.
- 1996 Anemia and the Transition of Nomadic Hunter-Gatherers to a Sedentary Lifestyle: Follow-up Study of a Kalahari Community. *American Journal of Physical Anthropology* 99:455–472.
- Kent, S., and H. Vierich
1989 The Myth of Ecological Determinism—Anticipated Mobility and Site Organization. In *Farmers as Hunters: The Implications of Sedentism*, edited by S. Kent, pp. 96–134. Cambridge University Press, Cambridge.
- Leonard, R., and G. T. Jones (editors)
1989 *Quantifying Diversity in Archaeology*. Cambridge University Press, Cambridge.
- McCartney, P., and M. Glass
1990 Simulation Models and the Interpretation of Archaeological Diversity. *American Antiquity* 55:521–536.
- Murray, P.
1980 Discard Location: The Ethnographic Data. *American Antiquity* 45:490–502.
- Plog, S., and M. Hegmon
1993 The Sample Size-Richness Relation: The Relevance of Research Questions, Sampling Strategies, and Behavioral Variation. *American Antiquity* 58:489–496.
- Rowley-Conwy, P., and M. Zvelebil
1989 Saving it for Later: Storage by Prehistoric Hunter-Gatherers in Europe. In *Bad Year Economics: Cultural Responses to Risk and Uncertainty*, edited by P. Halstead and J. O'Shea, pp. 40–56. Cambridge University Press, Cambridge.
- Schiffer, M.
1987 *Formation Processes of the Archaeological Record*. University of New Mexico Press, Albuquerque.
- Stevenson, M.
1985 The Formation of Artifact Assemblages at Workshop/Habitation Sites: Models from Peace Point in Northern Alberta. *American Antiquity* 50:63–81.
1991 Beyond the Formation of Hearth-Associated Artifact Assemblages. In *The Interpretation of Archaeological Spatial Patterning*, edited by E. Kroll and T. D. Price, pp. 269–299. Plenum Press, New York.
- Teachman, J.
1980 Analysis of Population Diversity: Measures of Qualitative Variation. *Sociological Methods and Research* 8(3):341–362.
- Testart, A.
1982 The Significance of Food Storage among Hunter-Gatherers: Residence Patterns, Population Densities, and Social Inequalities. *Current Anthropology* 23:523–537.
1988 The Social Anthropology of Hunter-Gatherers. *Current Anthropology* 29:1–31.

Notes

¹ Evenness also has been defined as the order of abundance values; richness at the number of classes (Jones and Leonard 1989:2; also see Cowgill 1989:135–136).

² T-test for windbreaks and refuse/ash areas at abandoned camps only: $t = -2.7$, $p = 0.0096$; for huts and refuse/ash areas: $t = 2.5879$, $p = 0.0115$; and for kraals and refuse/ash area: $t = 2.3$, $p = 0.0217$. NPAR1Way (SAS statistical package) analysis of variance $p = 0.0001$. Other loci at abandoned camps were not included in the statistical analyses because of their smaller n .

³ Plog and Hegmon (1993) have written that automatic decisions concerning sample size and diversity, without consideration of behavior that may have influenced both, can impede

our knowledge of the past, rather than promote it. It may be possible that sample size and diversity are related in some circumstances because of behavioral reasons, and not just intrinsic quantitative reasons associated with the statistic itself.

⁴ P_i is defined as if N population elements are divided into I arbitrary categories with the proportion of events falling in the i th category is p_i with

$$\sum_i p_i = 1$$

in the formula described as the Teachman statistic (that is:

$$DM = \sum_i p_i (\log (1/p_i))$$

where DM is diversity measure and p is the probability of objects within a category). So that if all events fall into one category, the measure should take a value of zero indicating no variation, if all $p_i = 1/I$, indicating that population events are equally distributed among all categories, the measure should reach its theoretical maximum ($\log I$). Additionally, it is desirable to norm such a measure so that it equals 1 indicating the highest degree of diversity and 0 indicating the least diversity. If $I+1$, $I+2$, etc., exists, additional categories to which no population members belong should leave the measure unaffected. In other words, given two populations, with elements evenly distributed across all categories, the

population with the greater number of categories should have the higher diversity. Conversely, combining two or more categories should not increase the measured diversity (Teachman 19;342–343)

⁵ My interpretation of Area A is that it served briefly as a midden during the initial habitation of the site while the kiva was being built. The orange-colored clayey soil for the prepared kiva floor was first dumped on the small midden when it was brought to camp. Most of the clayey soil was placed in the kiva to construct the floor, but what was not used was left covering the midden beneath it. After this time, the area was not used as a specific activity area. During the occupation of the camp, Area A was made into a very different non-refuse activity area with a hearth. Stratigraphically, it is possible to see that the people were not walking on exposed refuse when the hearth was built at Area A because the clayey soil capped the refuse and because enough time had elapsed to have a thin layer of soil on top of the clayey soil (anywhere from a few years to a decade or two). The hearth was one of the last features built at the site, which had an entire occupation spanning only around 20 to 30 years (see Kent 1991 for a detailed and a stratigraphic profile of Area A).

Received March 18, 1996; Accepted February 12, 1998;
Revised March 4, 1998.

Archaeology on the Great Plains

Edited by W. Raymond Wood

"A seminal work. It helps dispel the stereotypical view of life on the plains by examining the rich diversity of cultures and lifestyles that have existed in the region. The excellent maps convey a great deal of information." ~ *LIBRARY JOURNAL*. "Provides a much needed updating—the first in 35 years—of Plains archaeology." ~ SUSAN C. VEHIK, Associate Professor of Anthropology, University of Oklahoma. "Wood

and his colleagues have woven together an admirable tapestry that supersedes Wedel's seminal volume *Prehistoric Man on the Great Plains*." ~ R. BRUCE MCMILLAN, Director, Illinois State Museum. 528 pages, illustrated. \$29.95



UNIVERSITY PRESS OF KANSAS
2501 West 15th Street, Lawrence KS 66049

Available at bookstores or
from the press. VISA and
MasterCard accepted.
Phone 785-864-1155
Fax 785-864-4586